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The relationships among gender, cognitive styles, computer experience and computer attitudes in Upward Bound students

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The relationships among gender, cognitive styles, computer experience, and computer attitudes in Upward Bound students

by

Su-Chih Huang

A Thesis Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of MASTER OF SCIENCE

Department: Curriculum and Instruction
Major: Education (Curriculum and Instructional Technology)

Signatures have been redacted for privacy

Ames, Iowa
1993
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CHAPTER 1. INTRODUCTION

Background

Over the past several years, there has been a tremendous increase in the use and importance of computers in the workplace, the school, and the home. Between 1980 and 1989, the number of microcomputers and computer terminals in U.S. schools rose by nearly 50-fold from fewer than 50,000 to roughly 2,400,000 (Becker, 1991). For children in school, access to computers rose to 46% in 1989, up from 28% in 1984 (Kominski, 1991). On the other hand, in 1989, 36.8% of the more than 115 million employed adults used a computer at work, a significant increase from 24.6% in 1984 (Kominski, 1991). The U.S. Department of Labor estimates that for this next generation as much as 75% of all jobs will involve the use of computers (Bohlin, 1992). Therefore, computers are expected to play key roles in the future.

As computer-related technology is increasingly used in schools and computer-related skills are more important for the future career requirements, educators face new challenges about how to use and teach students to use computers effectively (Richards, Johnson, & Johnson, 1986). Effective implementation of computers in classrooms is problematic because all students do not respond in the same way to the use of computers. For some students, learning about or working with computers is like a creative, interesting, and challenging adventure. For others, however, computer experience is unpleasant because computers make them confused and upset. Koohang (1989) and Marcoulides (1991)
pointed out that negative computer attitudes may affect the process of learning and can be a deterrent to using computers in learning. Moreover, attitudes toward computers influence not only the acceptance of computers, but also future behaviors, such as using a computer as a professional tool (Woodrow, 1991).

It is essential for schools to provide students the opportunity and the encouragement to develop positive attitudes toward computers and the skills needed to use computers (Griffin, Gillis, & Brown, 1986). Sullivan (1989) stated that positive computer attitudes could facilitate learning about computers and contributed to productivity and more usage. Reece and Gable (1982) argued that if the curricula and laboratory experiences did not support the development of positive attitudes toward computers introducing computers into schools would be a waste of time and money.

Munger & Loyd (1989) reported at least four different types of computer-related attitudes that might reasonably be examined separately: computer interest/enjoyment, computer comfort/confidence as opposed to anxiety, computers as a male domain, and social impact of computers. It is important to investigate what factors affect attitudes toward computers because student attitudes toward computers may affect the process of learning and the development of skills they will need in the future. The interplay of many factors may be involved in the determination of computer attitudes. Previous research has partially attributed computer attitudes to gender, previous computer experience, computer literacy, the type of computer use, social context, age, culture,

Since attitude is a complex phenomenon, a variety of individual characteristics needed to be considered as possible factors. Connell (1991) suggested that the cognitive style provided insight into the student learning process and might therefore have a relationship to attitude toward computers. Cognitive styles are "the information processing habits representing the learner's typical mode of perceiving, thinking, problem solving, remembering, and problem solving" (Keefe, 1988). Studies (Billings & Cobb, 1992; Cavaiani, 1989; Cordell, 1990; Davidson, Savenye, & Orr, 1992; Pommersheim & Bell, 1986; Rowland & Stuessy,
have shown that cognitive styles were related to students' performance in computer-related courses. In Connell's (1991) and Frey's (1989) studies, they both found that cognitive styles were important determinants of computer attitudes. However, research relating the cognitive style factor to attitudes toward computers is scarce.

One key to effective teaching is to understand students' differences in cognitive styles and then design instruction and materials which accommodate individual learning needs (Thomson, 1986; Pettigrew, 1988). Claxton & Murrell (1987) and Dunn (1980) indicated that motivation and achievement increased when instruction was matched to learners' preferred learning modes. Many student changes in major were due to mismatches between personal learning styles and the learning demands of different disciplines (Keefe, 1988). Keefe (1988) also asserted that dissatisfaction with the workplace might result from mismatches between learning style preference and career choices.

While studies of children and computers are abundant, research is relatively scarce on Upward Bound students, who are potential first-generation college students and/or come from low-income families. The Upward Bound Program provides the following services: (1) providing career and academic counseling; (2) providing a program designed to improve the participants' academic skills in computer science, English, math, reading, science and social studies by a minimum of one year's growth in these areas; (3) providing every assistance available to secure postsecondary placement and the financial assistance required to attend the school of his/her choice; and (4) providing and/or assisting each
participant in developing mature plans for education, career, and lifestyle. To provide effective education and services for Upward Bound students, there is a need to examine their cognitive styles and their attitudes toward the potential technological invention, computers.

First, this research was conducted to identify Upward Bound students' cognitive styles. Second, this study attempted to investigate the relationships between cognitive styles and Upward Bound students' computer attitudes (anxiety, confidence, liking). Finally, the study was performed to replicate previous studies to determine if gender and computer experience were related to computer attitudes. The findings of this study can be useful to teachers in planning materials and instructional strategies, and to consultants in counseling Upward Bound student for educational-vocational choices.

The instrument used in this study for measuring attitudes toward computers was the Computer Attitude Scale (Loyd & Gressard, 1984) which was the most extensively used and tested scale. This Likert-type scale consists of 30 items, divided into three 10-item subscales: computer anxiety, computer confidence, and computer liking.

The inventory for assessing cognitive styles was the National Association of Secondary School Principals Learning Style Profile (NASSP LSP) (Keefe et al., 1989). The LSP contains 24 independent scales representing four higher order factors: cognitive skills, perceptual response, study preferences, and instructional preferences. Although the complete LSP was administered, the results of only six cognitive elements
(analytic, spatial, discrimination, categorization, sequential processing, memory) were used in the analysis.

Purpose of the Study

The first purpose of this study was to gain a better understanding of the cognitive styles of Upward Bound students. The second purpose was to investigate whether cognitive styles were related to gender and Upward Bound students' computer attitudes (anxiety, confidence, liking, respectively). Finally, this research attempted to replicate previous studies to examine if gender and computer experience could predict Upward Bound students' computer attitudes (anxiety, confidence, liking, respectively) and then made comparisons to past research.

Statement of the Problem

This study was designed to investigate the relationships among gender, cognitive styles, computer experience, and computer attitudes (anxiety, confidence, liking). Specifically, the study attempted to address the following questions:

Question 1: Are one or more of the six dimensions of the NASSP cognitive styles dominant within the Upward Bound students?

Question 2: Are there relationships between gender and cognitive styles?

Question 3: What are the effects of gender, computer experience, and cognitive styles on computer anxiety?
Question 4: What are the effects of gender, computer experience and cognitive styles on computer confidence?

Question 5: What are the effects of gender, computer experience and cognitive styles on computer liking?

Hypotheses of the Study

In order to effectively address the research questions and purposes of the study, the following research hypotheses will be examined. Conceptual models presented in Figure 1 and Figure 2 summarize the relationships hypothesized in this study.

Related to Question 1

1. One or more of the six dimensions of the NASSP cognitive styles are dominant within the Upward Bound students.

Related to Question 2

2. There are significant relationships between gender and cognitive styles.

   2.1. There is a significant relationship between gender and the analytic cognitive style.

   2.2. There is a significant relationship between gender and the spatial cognitive style.

   2.3. There is a significant relationship between gender and the discrimination cognitive style.

   2.4. There is a significant relationship between gender and the categorization cognitive style.
Figure 1: Model of relationships between gender and cognitive styles for the total sample (77 students)

Figure 2: Model of relationships between independent variables and dependent variables for 58 students, who participated in both the NASSP Learning Style Profile test and the Computer Attitude Scale test
2.5. There is a significant relationship between gender and the sequential processing cognitive style.

2.6. There is a significant relationship between gender and the memory cognitive style.

Related to Question 3

3. Gender contributes significantly to the variance in computer anxiety after controlling for computer experience, computer literacy course, and cognitive styles.

4. Computer experience contributes significantly to the variance in computer anxiety after controlling for gender, computer literacy course, and cognitive styles.

5. Cognitive styles contribute significantly to the variance in computer anxiety.

5.1. The analytic cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

5.2. The spatial cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

5.3. The discrimination cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.
5.4. The categorization cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

5.5. The sequential processing cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

5.6. The memory cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Related to Question 4

6. Gender contributes significantly to the variance in computer confidence after controlling for computer experience, computer literacy course, and cognitive styles.

7. Computer experience contributes significantly to the variance in computer confidence after controlling for gender, computer literacy course, and cognitive styles.

8. Cognitive styles contribute significantly to the variance in computer confidence.

8.1. The analytic cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.
8.2. The spatial cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

8.3. The discrimination cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

8.4. The categorization cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

8.5. The sequential processing cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

8.6. The memory cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Related to Question 5

9. Gender contributes significantly to the variance in computer liking after controlling for computer experience, computer literacy course, and cognitive styles.
10. **Computer experience** contributes significantly to the variance in **computer liking** after controlling for gender, computer literacy course, and cognitive styles.

11. **Cognitive styles** contribute significantly to the variance in **computer liking**.

11.1. The **analytic** cognitive style contributes significantly to the variance in **computer liking** after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

11.2. The **spatial** cognitive style contributes significantly to the variance in **computer liking** after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

11.3. The **discrimination** cognitive style contributes significantly to the variance in **computer liking** after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

11.4. The **categorization** cognitive style contributes significantly to the variance in **computer liking** after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

11.5. The **sequential processing** cognitive style contributes significantly to the variance in **computer liking** after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.
11.6. The memory cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Significance of the Study

Substantial research has been conducted in the areas of cognitive styles and computer attitudes, yet little research focused on Upward Bound students. Besides, there is a lack of research that investigate the influence of cognitive styles on computer attitudes. Thus, in addition to meeting this call for research relative to Upward Bound students' cognitive styles, this study also provides insight into these students' computer attitudes. Furthermore, the findings of this research can be useful for teachers to plan instructional strategies and materials, for Upward Bound staff to design curricula, and for consultants to counsel Upward Bound students in making educational-vocational choices.

Dependent and Independent Variables

**Dependent variables:**
1. Computer anxiety as measured by Computer Attitude Scale
2. Computer confident as measured by Computer Attitude Scale
3. Computer liking as measured by Computer Attitude Scale

**Independent variables:**
1. Gender (two levels: males/females)
2. Cognitive style (analytic, spatial, discrimination, categorization, sequential processing, memory) as measured by National Association of Secondary School Principals Learning Style Profile

3. Computer experience (five levels: 1 week or less/more than 1 week to 1 month/more than 1 month to 6 months/more than 6 months to 1 year/more than 1 year)

4. Computer literacy course (two levels: have ever taken/have never taken)

**Definitions**

**Learning style:**
The composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment.

**Cognitive style:**
Information processing habits presenting the learner's typical mode of perceiving, thinking, problem solving, and remembering.

**Analytic skill:**
To identify simple figures hidden in a complex field; to use the critical element of a problem in a different way.

**Spatial skill:**
To identify geometric shapes and rotate objects in the imagination; to recognize and construct objects in mental space.
**Discrimination skill:**
To visualize the important elements of a task; to focus attention on required detail and avoid distractions.

**Categorization skill:**
To use reasonable vs. vague criteria for classifying information; to form accurate, complete, and organized categories of information.

**Sequential processing skill:**
To process information sequentially and verbally; to readily derive meaning from information presented sequentially or verbally.

**Memory skill:**
To retain distinct vs. vague images in repeated tasks; to detect and remember subtle changes in information.

**Computer anxiety:**
The fear and apprehension felt by an individual when considering the implications of utilizing computer technology, or when actually using computer technology.

**Computer confidence:**
Confidence in the ability to learn about or use computers.

**Computer liking:**
Enjoyment or liking of computers and using computers.

**Assumptions**
The basic assumptions of this study are:

1. NASSP Learning Style Profile is a valid and reliable instrument for diagnosing cognitive styles.
2. Loyd and Gressard's Computer Attitude Scale is a valid and reliable instrument for assessing computer anxiety, computer confidence, computer liking.

3. The subjects responded to the items on the Learning Style Profile and the Computer Attitude Scale in a truthful manner.

Limitations

This study was conducted using subjects participating in the Upward Bound Program at Iowa State University. Upward Bound is a federally funded college preparatory program for students who are from low-income families and/or are potential first-generation college students. Therefore, no attempt should be made to generalize results from this sample to other populations.
CHAPTER 2. REVIEW OF LITERATURE

The review is focused on literature pertaining to theory about cognitive style and to research investigating relationships among cognitive style, gender, computer experience, socioeconomic status and attitudes toward computers. This chapter is organized into the following six sections: (1) cognitive style; (2) factors affecting cognitive style; (3) cognitive style and computer attitudes; (4) gender and computer attitudes; (5) computer experience and computer attitudes; and (6) socioeconomic status and computer attitudes.

Cognitive Style

The concept of individual differences within humans is not new. Approximately twenty-four hundred years ago, Confucius, the great Chinese educator, had asserted that teaching strategies should be based on learners' characteristics. In the eighteenth century, Rousseau addressed the needs of the individual in *Emile*.

Over the past two decades, efforts to understand learners' differences in school performance or normal intelligence, have shifted the focus from standard intelligence tests to tests of cognitive styles. Shifting the focus from intelligence to cognitive style tests was based on the assumption that for children who did not differ in their IQ, performance differences arose not from ability differences but rather from the manner in which children solved various problems (Zelniker, 1989).
The formation of cognitive style in the field of psychology began in the 1920's. In 1953, Gardner termed "cognitive control principles" as "cognitive style" (Smith, 1974). Although the terms "cognitive style" and "learning style" are used synonymously in the literature, they are not the same. Based on Keefe (1987b), learning style is the broader term which consists of cognitive, affective, and physiological styles.

Messick (1976) conceptualized cognitive styles as "stable attitudes, preferences, or habitual strategies determining a person's typical modes of perceiving, remembering, thinking, and problem solving." Cognitive styles reflect genetic coding, personality development, motivation, and environmental adaptation. It can change, but it does so gradually and developmentally (Keefe, 1988). Hudson (cited in Messick, 1984) pointed out that "cognitive styles are not categories or types but dimensions of continuous variation; not pigeon holes but sign posts for characterizing individual propensities; not merely behavioral differences but tendencies or tensions underlying the surface of intellectual life."

In general, cognitive styles have four essential characteristics. First, cognitive styles are concerned with the form rather than the content of cognitive activity. They refer to individual differences in how persons perceive, think, solve problems, learn, and relate to others. Second, cognitive styles are pervasive dimensions. This means cognitive styles cut across cognitive, intellective, personality, and interpersonal domains and are not alone of cognition in the narrow sense. Third, cognitive styles are stable over time. Yet, this does not imply that they are unchangeable; some may easily be altered. Fourth, cognitive styles
are value differentiated. Each stylistic extreme has adaptive value but in different circumstances (Messick, 1984; Witkin et al., 1977).

Cognitive styles have been moderately good predictors of performance on various tasks (Zelniker, 1989). Messick (1984) noted that cognitive styles related to education in six main ways: (1) improving instructional methods, (2) enriching teacher behavior and conceptions, (3) enhancing student learning and thinking strategies, (4) expanding guidance and educational-vocational decision making, (5) broadening educational goals and outcomes, (6) tuning the stylistic demands of learning environments.

The theoretical models of cognitive styles vary considerably. Witkin's conceptual model which denoted the field-dependence/field-independence components of cognitive style is probably the most widely known. Kagan's and Kogan's model focused on reflection vs. impulsivity dominance. In addition, McKenney developed a model which is bi-dimensional rather than simply bi-polar. In this model, human information processing has two dimensions: information gathering (perceptive vs. receptive) and information evaluating (systematic vs. intuitive) (Keefe, 1987b).

Literature reports numerous instruments devised for assessing cognitive styles. The five widely used instruments are as follows:

**The Group Embedded Figures Test (GEFT)**

The GEFT developed by Harold Witkin is used to assess one cognitive dimension: field-independence (analytical) vs. field-dependence (global). The test presents twenty-five complex test figures within which
are embedded simple figures subjects must outline (Schafer, 1992). Field-independent persons see things apart from the background; they viewed objects and ideas apart from the whole. In contrast, field-dependent persons are influenced by the overall organization of the background; they have difficulty separating parts and viewed objects and ideas in their context or surroundings. Field-dependent persons' perception tends to be broad in nature, but field-independent persons perceive their surrounding in a analytical fashion (Witkin et al., 1977).

Strengths of the field-independent learners were derived from their superior cognitive restructuring skills, whereas the strengths of the field-dependent learners were derived from their superior social skills. As a result of extensive research Witkin concluded that field-dependence-independence was stable throughout most of life; it was related somewhat with gender, and affected the amount one learned in given subject areas. He had also found that it affected one's selective course, college majors, and vocational choices (Witkin et al., 1977).

Kolb's Learning Style Inventory

Kolb (1985) developed an inventory of learning styles in which respondents rank order of twelve sets of four words concerning learning preferences. Kolb's model defined four learning styles corresponding to each possible combination of preferred ways to perceive and to process new information. The four learning styles are as follows:

1. **Divergers** grasp the experience through concrete experience and transform it through reflective observation. Their major strength is their imaginative ability. They like to view situations from different
perspectives and then weave many relationships into a meaningful whole. They are called divergers because they are good at generating ideas and brainstorming.

2. **Assimilators** grasp the experience through abstract conceptualization and transform it through reflective observation. Their primary strength is their ability to create theoretical models, and they are called assimilators because they like to assimilate diverse data into an integrated whole.

3. **Convergers** grasp the experience through abstract conceptualization and transform it through active experimentation. Their strength lies in the practical application of ideas, and they are called convergers because, when presented with a question or task, they move quickly (converge) to find the one correct answer.

4. **Accommodators** grasp the experience through concrete experience and transform it through active experimentation. Their strengths lie in actually doing things, in carrying out plans and experiments, and involving themselves in new experiences.

**Myers-Briggs Type Indicator (MBTI)**

The Myers-Briggs Type Indicator designed by Myers and Briggs assesses both cognitive and affective domains. It is based on Carl Jung's theory of psychological types. The MBTI examines four dimensions of cognitive styles, and thereby categorizes individuals into 16 types (Carland & Carland, 1990). The four scales of the MBTI are:
1. **Extroversion vs. Introversion scale:** This scale measures the preferred attitude individuals possess toward the outer vs. the inner world (outward looking or inward looking).

2. **Sensation vs. Intuition scale:** This scale measures which kind of perception an individual prefers (perceiving through the senses or insight).

3. **Thinking vs. Feeling scale:** This scale measures which kind of judgment an individual prefers in decision making.

4. **Judgment vs. Perception scale:** This scale measures whether an individual prefers to deal with the world in a judging or perceptive mode.

**Cognitive Profiles**

Letteri developed the Cognitive Profiles by combining several existing cognitive styles elements in a multi-dimension profile that predicts student achievement on standardized achievement tests. The Cognitive Profile charts the students' position across seven cognitive continuums: (1) field-independence vs. field-dependence, (2) scanning vs. focusing, (3) breadth of categorization, (4) complexity vs. simplicity, (5) reflectiveness vs. impulsivity, (6) leveling vs. sharpening, (7) tolerance vs. intolerance. The Cognitive Profile is designed in a problem-solving format, whereby students must perform a task rather than respond in a self-report (Debello, 1989; Frey, 1989; Keefe 1987b).
NASSP Learning Style Profile

The LSP was developed by the National Association of Secondary School Principals Learning Style Task Force under the leadership of Dr. Keefe. It is a multi-dimension instrument that assesses a broad spectrum of researched-based learning style elements. The instrument consists of 126 test items that make up 24 independent subscales. These subscales represent the four higher order factors of cognitive skills, perceptual responses, study preferences, and instructional preferences. Letteri’s information procession perspective was adopted as the basis for the Task Force conceptual model of style (Keefe, 1987a). Cognitive skill items were derived from Witkin’s Group Embedded Figures Test. There are seven subscales in the cognitive dimension:

1. **Analytical Skill**:

   Analytic skill is the capability of identifying figures concealed in a complex background field. The skill of analysis requires that the student break down an idea, concept, or problem into its component parts and then put it back together again. Persons high in this skill excel in separating a part from a whole, and in using the critical element of a problem in a different way—processes that are particularly important in such fields as mathematics and the sciences (Keefe, 1988; Jenkins, 1990).

2. **Spatial Skill**:

   Spatial skill is the ability to identify geometric shapes and rotate objects in the imagination. Students with strong spatial skills are able to visualize an object from different perspectives. Because they
have a better picture of the object or idea, they can better see where it fits into categories of information they already possess. Strong spatial learners can create spatial models to represent concepts (Jenkins, 1990). Some evidence links spatial reasoning skill with success in aspects of mathematics, in technical courses, and in related occupations (Keefe, 1988).

3. **Discrimination Skill:**
   Discrimination skill is the capability of visualizing the important elements of a task and focusing attention on the required dimensions of a task and avoiding distractions. This scale is based on the cognitive style of focusing vs. scanning. When new information is presented, students with strong discrimination skills are able to focus on the critical information and to filter the relevant from the less relevant details (Keefe, 1988).

4. **Categorization Skill:**
   Categorization skill refers to use reasonable vs. vague criteria for classifying information. Categorization is taking new information and placing it in the existing structures of long-term memory or creating new categories when none exist (Jenkins, 1990). Narrow categorizers tend to use more complete and more accurate categories to classify information. Broad categorizers lack accuracy and organization in these tasks (Keefe, 1988).

5. **Sequential Processing Skill:**
   Sequential processing skill refers to a learner's capability or bias for processing information in a step-by-step, linear fashion. Persons with
high sequential processing skills excel in or prefer verbal and other linear modes of processing (Keefe, 1988).

6. Memory Skill:
Memory skill is the capability of retaining distinct rather than vague images in repeated tasks— to detect and identify subtle changes in information. It is based on the cognitive style of leveling vs. sharpening. Sharpeners show strength in differentiating new information from old; levelers do not (Keefe, 1988). Students with strong memory skills are able to recall accurate information when required to do so. Success in school is closely related to skill in remembering information accurately (Jenkins, 1990).

7. Simultaneous Processing Skill:
Simultaneous Processing skill is the capability or bias for integrating the separate elements of experience into a whole, or gestalt. Persons with high simultaneous processing skills excel in nonverbal, figural tasks requiring the grasping of a spatial or visual gestalt (Keefe, 1988).

The focus of this current study includes six subscales only from the cognitive dimension of the NASSP Learning Style Profile: (1) analytic skill, (2) spatial skill, (3) discrimination skill, (4) categorization skill, (5) sequential processing skill, and (6) memory skill.

Factors Affecting Cognitive Style

Gender

Significant gender differences in cognitive styles were documented in Tucker's study (1983) of eighth grade students with Kolb's Learning
Style Inventory. He found that males scored significantly higher than the females on the abstract conceptualization scale.

Carland and Carland (1990) administered the Myers-Briggs Type Indicator instrument to 92 college students and reported that males had preferred attitudes toward the inner world (introversion), but females had preferred attitudes toward the outer world (extroversion). They also discovered that the preferences of the females subjects were in the same direction as for the males on the Thinking vs. Feeling scale, but females had a significantly stronger preference for feeling than males.

In his review of the literature on gender differences in field-dependence/field-independence, Demick (1991) reported that much research conducted with adolescent/adults in Western cultures had been in agreement with females consistently reported to exhibit greater field-dependence than males. However, studies conducted with preschool children surprisingly revealed the preschool girls had been consistently reported to exhibit greater field-independence than their male counterparts.

Culture and Race

According to Witkin (1967), cultural values reflected in socialization practices affect development of cognitive styles in children. For example, Manuel and Douglas (1974) assessed cognitive styles of three subcultural groups in the United States--Caucasian-Americans, African-Americans, and Mexican-Americans in grades 4 by using the Portable Rod and Frame Test. The results showed that African-American and Mexican-American children scored in a significantly more field-
dependent direction than Caucasian-American children. The authors noted that members of groups which emphasized respect for family and religious authority and group identity, and which were characterized by shared-function family and friendship groups, tended to be field-dependent (relational cognitive style). In comparison, members of groups which encouraged questioning of convention and an individual identity and were characterized by formally organized family and friendship groups tended to be more field-independent (analytic cognitive style).

The data in the study also indicated that females scored in a more field-dependent direction than males. The finding suggested that females were socialized toward greater respect for family and religious authority and a more intensive group identification, and were reared in a more shared-function environment than males.

The majority of urban Caucasian students process information in a logical, sequential, linear fashion. They learn easily when learning is done step by step, beginning with the parts and building toward the whole. On contrary to Caucasian students, the majority of Native Americans are global learners who are good at seeing the unity and harmony in the larger situation. They learn much more easily if they can see the overall picture before they concern themselves with the details (Gilliland, 1992). Diessner and Walker (1986) investigated the cognitive style of Yakima Native-American junior and senior high school students in the Columbia River Basin by using the Wechsler Scale. They found that Yakima students exhibited a pattern of Spatial Ability greater than Sequential Ability, which is greater than Verbal Conceptual Ability.
Socioeconomic Status

Bjorklund and Weiss (1985) investigated the influence of socioeconomic status (SES) on cognitive skills. Subjects were kindergarten and first-grade children and they were divided into three SES levels based on their parents educational level (college, high school, or less than high school). The results revealed that no significant differences in levels of recall and clustering in recall as a function of SES. Similarly, an earlier study by Manuel and Douglas (1974) also indicated that no significant relationship existed between SES and cognitive style.

Cognitive Style and Computer Attitudes

Previous research using various definitions of cognitive style investigated the influence of cognitive style on attitudes toward computer-related technology and indicated a variety of results.

A study conducted by Frey (1989) showed that students had individual cognitive styles and preferences for processing through a hypermedia program. In her study 79 college students were administered the NASSP Learning Style Profile and completed Belief About Computer Scale tests before and after using a hypermedia program. Subjects with strong memory skills tended to have favorable pre-attitudes toward computers; subjects with strong sequential processing skills tended to have pre- and post-attitudes toward computers; subjects with strong discrimination skills also had favorable post-attitudes toward computers. Similarly, in a study of 6th through 9th grade students, Connell (1991) also employed the NASSP Learning
Style Profile and found that analytic, and sequential processing skills were positively related with students' attitudes toward computers.

In another study, Chu and Spires (1991) used Myers-Briggs Type Indicator which had four classes: intuitive/sensing, thinking/feeling, extrovert/introvert, judging/perceiving. They found that intuitive and thinking individuals exhibited significantly lower anxiety than their sensing and feeling counterparts. Similarly, Schafer (1992) using Myers-Briggs Type Indicator and Group Embedded Figures Test investigated the effect of learner characteristics on attitudes toward using a hypermedia learning system. Field dependent subjects' attitudes toward comfort with computers were found to be more positive than field independent subjects' attitudes. Additionally, subjects preferring perception had a more positive attitude toward comfort than judging subjects. Extroverts also had a more positive attitude toward comfort with computers than introverts.

Brudenell and Carpenter (1990) using Kolb's learning style model categorized subjects into one of four modes: accommodator (prefers active experimentation and concrete experience), diverger (excels in concrete experience and reflective observation), converger (prefers abstract conceptualization and active experimentation), and assimilator (prefers abstract conceptualization and reflective observation). They found that students with all four learning modes had greater negative attitudes on the function subscale and assimilators had greater negative attitudes on the creativity subscale. In a recent study, however, Billings and Cobb (1992) using Kolb's Learning Style Inventory reported no
significant differences between acceptance of interactive video instruction and students' learning style preferences.

Gender and Computer Attitudes

A great deal of research has been conducted on gender differences, in a variety of age groups, regarding attitudes toward computers. Most studies have used a quantitative and survey approach to examine differences between males and females. However, results in this area are conflicting, because the studies are based on different kinds of variables.

In a recent comprehensive review of literature, Kay (1992b) found that out of 98 instances of attitude measurement, males had more positive attitudes on 48 occasions, females had more positive attitudes on 14 occasions, and males and females had similar attitudes on 36 occasions. In another review of literature, Nelson and Watson (1990-1991) concluded that in preschool and the early elementary grades, no significant sex-typed differences were apparent. By the third or fourth grade, however, disparities in computer attitudes between girls and boys revealed that girls were less technologically motivated and less interested in future computer experiences. In high school, this trend became even more prominent.

DeRemer (1989) in a study of 3rd and 6th graders found that girls were as confident as boys in their ability to learn with and about computers but they liked computers more than boys did. Findings also showed that girls did not feel that computers were a male domain, whereas boys strongly felt that computers were their domain.
According to Griffin et al. (1986), at the middle school level, boys had significantly more positive attitudes than did girls. However, Connel (1991) reported that there was no statistically significant difference in attitude toward computers between males and females in grades six through nine. Similarly, Nelson and Cooper (1989) working with the fifth graders reported that both boys and girls were enthusiastic about using computers and have positive attitudes toward computers. Contrary to the work of DeRemer (1989), girls in the study felt that they had less ability with computers than did boys.

Collis was representative of researchers that conducted studies in gender differences. In his extensive survey (1985) on 1,818 eighth- and twelfth-grade students in British Columbia, Canada, he reported that males were more interested and self-confident in computers than were females. This finding was supported by Sullivan's study (1989). Collis's additional interesting finding uncovered the "We can, but I can't" paradox with respect to females' attitudes toward computers. He found that girls in both grades strongly agreed with statements about females being as competent as males with computers but they, as individuals, were not competent or likely to be computer users. The result was affirmed by other studies (Chen, 1986; Jacobson, 1991; Temple & Lips, 1989). Levin & Gordon (1989) contended that the lack of confidence in computers among female high school students might result from cultural biases that stereotyped computing as a male domain.

Using a survey of 1,138 students from five Bay Area high schools in California, Chen's study (1986) indicated that males exhibited more
positive attitudes toward computers on these scales: computer interest, computer confidence, and computer anxiety. However, after controlling for similar amount of experience, males and females responded with similar levels of interest. Males continued to report greater confidence and less anxiety with computers than females with similar amounts of experience. Chen suggested that a chief source of gender differences in attitudes was the greater willingness of males to participated in computer experience.

Several studies indicated that gender was not significantly related to computer anxiety at the high school level (Campbell, 1989; Loyd and Gressard, 1984). On the other hand, Jacobson (1991) worked with high school seniors during the course of a year-long intensive library research experience and found that girls had significantly higher computer anxiety than boys.

Contrary to previous attitudinal research conducted in coeducational situations, Arnan's study (1992) was done in two gender-segregated Catholic high schools in an upper-middle-class area. Surprisingly, he found that females held consistently and strongly more positive computer attitudes than males. He contended that in a single-sex educational environment, gender was a significant predictor of computer attitudes.

At the college level, results in this area are somewhat varying. Two studies indicates that men and women did not differ significantly in computer anxiety (Chu & Spires, 1991; Cohen & Waugh, 1989). Additionally, Temple and Lips (1989) found that males and females did
not differ on their personal interest in and enjoyment of computers, but males reported more comfort and confidence with computers. However, in a recent survey, Massoud (1991) found that males significantly exhibited more interest and confidence but less anxiety in computers than females. Pope-Davis and Twing (1991) found that gender did not significantly influence computer anxiety, computer confidence, and computer liking. Further findings of Robinson-Staveley and Cooper’s (1988) study indicated that men and women were differentially affected by the presence of another person. They reported that for low-experience women, those who worked in the presence of another expressed more anxiety and more negative attitudes toward computers than did women alone, while low-experience men in the presence of another expressed less anxiety and less negative attitude than did men alone. Nevertheless, the effect of presence of another did not occur for high-experience subjects.

The studies concerning gender and computer attitudes attracted international interest. In addition to the study from America and Canada, other studies concerned with computer attitudes and gender were done in Israel, Turkey, Spain, Scotland. Fariña et al. study (1991) with Spanish college students showed that women suffered greater anxiety towards computers than men. Levin and Gordon (1989) reported that Israeli boys in grades 8 through 10 perceived computers as being more interesting, enjoyable, understandable, important, and friendly than girls did. Besides, they had more positive attitudes toward the computers as a medium of instruction than girls. Yet Askar et al. (1992)
found that there was no significant relationship between gender and computer attitudes in fifth grade Turkey students which is consistent with another study in Scotland college students by Durndell et al. (1987).

Collis and Williams (1987) conducted a cross-cultural study in which they examined the attitudes of two samples of adolescents totaling 2,105 from Canada and People's Republic of China toward computers and selected school subjects. The Chinese students exhibited fewer gender differences except when asked to give opinions about the competence of females with regard to computer use and science. In both countries, females agreed that women have as much ability as men in these areas, yet males were significantly more skeptical about female ability to use computers. In another cross-cultural research on 8- to 12-year-old American and Soviet students, Martin et al. (1992) examine the students' attitudes toward computers by comparing their responses to attitude statements and their drawings of computer users. The attitudes of the children from both countries were found to be very similar and mostly positive. No significant difference was found in responses to the attitude items by gender. An interesting finding was that significant gender differences occurred in the drawings of computers with most boys drawing males and most girls drawing females as computer users. The analysis of picture data revealed that the children saw themselves as computer users now and expressed the belief that they will be computer users in the future.

Unfortunately, most research in this area simply identified differences rather than provided clues about why males and females
differ in their attitudes toward computers. Thus, Kay (1992a) asserted that researchers must move from simply identifying differences to understanding them with a qualitative, contextual and dynamic approach that looks at specific cognitive tasks.

Computer Experience and Computer Attitudes

A positive relationship between amount of experience with computers and favorable attitudes toward computers is one of the more consistent findings in the literature. For example, in a study of 561 seventh and eighth grade students, Loyd, Loyd, and Gressard (1987) explored the effects of gender and amount of computer experience on the attitudes (computer anxiety, confidence, liking) as measured by the Computer Attitude Scale. The amount of computer experience was divided into the four levels: (1) less than 1 month; (2) more than 1 month but less than 6 months; (3) 6 months to 1 year; and (4) more than 1 year. They found that students with more computer experience were significantly less anxious, more confident, and more favorable than those with less computer experience about working with and learning about computers. The finding is consistent with the results of Okebukola et al. study (1991-1992) in the middle and high school students, Loyd and Gressard’s study (1984) in high school and college students and Koohang’s study (1989) in college students. Loyd and Gressard (1984) stated that as students became more familiar with computers, it was expected that computer anxiety produced in part by lack of familiarity
would decrease, and computer confidence and computer liking would increase.

Also, Aman (1992) argued that regular, hands-on computer experiences played an important role in forming positive attitudes. In his study with 1250 students from two gender-segregated high schools, he found that the amount of computer experience was related to computer attitudes with more computer experience corresponding to more positive computer attitudes. The finding is supported by another study conducted by Durndell et al. (1987) in Scotland college students.

Similarly, Levin and Gordon (1989) reported that among eighth through tenth grade Israeli students prior computer experience had a stronger effect on computer attitudes than gender. Furthermore, Wu and Morgan (1989) found that although female college students were more likely to ascribe social impacts to computers, the more time they spent using computers, the more they described computers as "fun," "warm," "friendly," and "interesting."

Moreover, Cohen and Waugh (1989) and Fariña, et al. (1991) found that college students with most computer experience suffered less anxiety toward computers. They asserted that the initial anxiety students experienced was a natural reaction which could diminish over time. In another study by Abou-Dagaa (1991), the amount of college students' computer experience was found to be significantly and positively related to their computer confidence, suggesting that more experience corresponds with higher computer confidence. The author explained that building a strong experiential background with computers
would enhance one's computer confidence which naturally guided more computer use.

However, a recent study by Pope-Davis and Twing (1991) did not support the finding that more computer experience led to more positive computer attitudes. Subjects in the study were 207 college students enrolled in an introductory computer skills course. Computer experience (less than 1 year, 1 to 3 years, more than 3 years) was examined in relation to computer attitudes (anxiety, confidence, liking, and usefulness). Contrary to the work of Koohang (1989), Loyd and Gressard (1984) and Loyd, Loyd, and Gressard (1987), computer experience was found to be a significant factor on only the liking subscale. The different results can be attributed to computer experience being evaluated in this study in terms of years while the other three studies evaluated computer experience in terms of weeks and months. Another possible reason for the discrepancy is that the increased emphasis on the teaching and use of computer technology in the schools in the recent years may be eliminating the "computer anxiety" reported in earlier research.

Socioeconomic Status and Computer Attitudes

Hativa (1989) studied the attitudes of Israeli students toward computer-assisted instruction. A sample of 247 grade three and grade four students from both high and low SES schools were administered a questionnaire. Results of this investigation indicated that students of lower SES level like the CAI work significantly more than the other students. Hativa concluded that the reasons for liking the CAI work,
chosen in high proportions by low SES students, are: the positive feedback that the computer presents on correct solutions; their liking of arithmetic; the typing rather than writing on paper; the frequent evaluations; and the competition with classmates.

However, Chambers and Clarke (1987) found that SES was not related to computer attitudes. In their study, they surveyed 951 students from four elementary and three secondary schools in Austria at the beginning and the end of the 1985 school year. The results revealed that although high SES students had more initial computing knowledge than low SES students, the high and low SES groups had comparable attitude toward computers.

The research cited above provides some insight into the relationship between students’ socioeconomic status and their attitudes toward computers. However, due to the limited number of studies and the inconsistencies in the findings, further research is warranted.

Summary

This chapter provides a review of related literature and research about cognitive style and individual differences in computer attitudes based on cognitive style, gender, computer experience, and socioeconomic status. A summary of this review indicates that:

- Significant gender differences in cognitive styles were documented in several studies.
- There was sufficient information to expect correlation between culture, race and cognitive style.
• The empirical research on the effects of socioeconomic status on cognitive style was limited. Two studies indicated no significant relationships existed between SES and cognitive style.

• There were significant relationships between cognitive styles and attitudes toward computers.

• There was no clear connection between gender differences and computer attitudes.

• A positive relationship between computer experience and computer attitudes was the more consistent finding in the literature.

• The empirical research on the effects of socioeconomic status on computer attitudes also was limited. One study showed that there were SES differences in attitudes toward computers but the other study showed that the high and low SES students had comparable attitude toward computers.
CHAPTER 3. METHODOLOGY

This chapter is divided into four sections: (1) description of subjects; (2) description of instruments; (3) procedures; and (4) data analysis.

Subjects

The population consisted of 77 students from grades 8 to 12 who participated in the Upward Bound Program at Iowa State University in 1993. These participants were from Ames, Fort Dodge, and Marshalltown school districts who met the following criteria:

1. Must be enrolled in grades 8-12.
2. Must be from low-income families and/or be potential first-generation college students from families in which neither parent has a four-year college degree.
3. Must exhibit motivation to gain admission to a postsecondary educational institution and demonstrate the potential to attend and complete a postsecondary educational program.

Seventy-seven subjects (37 males and 40 females) completed the NASSP Learning Style Profile tests. As shown in Table 1, there was a nearly equal gender balance, represented by grade levels of 8 through 12, with over half of the students in grades 8 and 9. Three-fourths were Caucasian, with several other racial groups making up the balance of students.
Table 1: Demographic characteristics of the total sample (77 students)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>37</td>
<td>48.1</td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td>58.9</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>26</td>
<td>33.8</td>
</tr>
<tr>
<td>9</td>
<td>28</td>
<td>36.4</td>
</tr>
<tr>
<td>10</td>
<td>13</td>
<td>16.9</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian-American</td>
<td>58</td>
<td>75.3</td>
</tr>
<tr>
<td>African-American</td>
<td>6</td>
<td>7.8</td>
</tr>
<tr>
<td>Asian-American</td>
<td>4</td>
<td>5.2</td>
</tr>
<tr>
<td>Native-American</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Hispanic-American</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3.9</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Only 58 of the 77 subjects took the Computer Attitude Scale tests and responded to the self-report questionnaires. This group was utilized for the analysis of computer attitudes. Of these students, 29 (50%) were males and 29 (50%) were females. Caucasian (72.4%) were dominant within these students. Most of these students had more than one year of computer experience (51.7%) and had ever taken computer literacy courses (86.2%). The demographic characteristics of the 58 students are shown in Table 2.
Table 2: Demographic characteristics of the 58 subjects, who took both the Learning Style Profile and the Computer Attitude Scale tests, and responded to the self-report questionnaires

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29</td>
<td>50.0</td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>50.0</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>25.9</td>
</tr>
<tr>
<td>9</td>
<td>25</td>
<td>43.1</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>13.8</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>10.3</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>6.9</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian-American</td>
<td>42</td>
<td>72.4</td>
</tr>
<tr>
<td>African-American</td>
<td>5</td>
<td>8.6</td>
</tr>
<tr>
<td>Asian-American</td>
<td>4</td>
<td>6.9</td>
</tr>
<tr>
<td>Native-American</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td>Hispanic-American</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>5.2</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Computer Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 week or less</td>
<td>2</td>
<td>3.4</td>
</tr>
<tr>
<td>more than 1 week to 1 month</td>
<td>8</td>
<td>13.8</td>
</tr>
<tr>
<td>more than 1 month to 6 months</td>
<td>5</td>
<td>8.6</td>
</tr>
<tr>
<td>more than 6 months to 1 year</td>
<td>13</td>
<td>22.4</td>
</tr>
<tr>
<td>more than 1 year</td>
<td>30</td>
<td>51.7</td>
</tr>
<tr>
<td><strong>Computer Literacy Course</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have taken</td>
<td>50</td>
<td>86.2</td>
</tr>
<tr>
<td>Have never taken</td>
<td>8</td>
<td>13.8</td>
</tr>
<tr>
<td><strong>Upward Bound Computer Science</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have taken</td>
<td>32</td>
<td>55.2</td>
</tr>
<tr>
<td>Have never taken</td>
<td>26</td>
<td>44.8</td>
</tr>
</tbody>
</table>
Instruments

The data collection was done through a survey consisting of three instruments: (1) the National Association of Secondary School Principals (NASSP) Learning Style Profile; (2) the self-report questionnaire; and (3) the Computer Attitude Scale.

The NASSP Learning Style Profile (LSP)

Cognitive styles were assessed with the 1989 revised edition of the NASSP Learning Style Profile (Keefe et al., 1989, see Appendix A-1 through Appendix A-6). The instrument was developed in four phases from the fall of 1983 to early 1986 and then published in the fall of 1986 (Keefe, 1988). This newest and most sophisticated learning style inventory based on the research and design of earlier work in the field was the work of a task force of learning style theorists and practitioners (Jenkins et al., 1990).

Its purpose is to provide educators with a well-validated and easy-to-use instrument for diagnosing the cognitive styles, perceptual response tendencies, study preferences, and instructional preferences of middle level and senior high school students. The LSP is intended to help teachers identify student learning style strengths and weaknesses and thereby organize instruction more efficiently and effectively.

The LSP requires 30 to 45 minutes to administer and contains 126 multiple choice or Likert-type questions. It consists of 24 independent scales representing the four higher order factors of cognitive skills, perceptual responses, study preferences, and instructional preferences. The focus of this study included scales only from the cognitive skill area:
analytic, spatial, discrimination, categorization, sequential processing, and memory skills. The simultaneous processing subscale was deleted in the study because its internal consistency reliability (alpha = .27) was low.

Twenty-two of the 24 scales were normed on a national random sample of 5,154 students representing all grades from 6 through 12. The sample was drawn from the NASSP data bank of American schools and stratified by public schools (90%), and private schools (10%), senior high schools (60%), and middle level schools (40%) (Keefe & Monk, 1990).

The average internal consistency reliability (Cronbach's alpha) for subscales is .63, with a range from .47 to .86 (Keefe & Monk, 1990). These reliabilities are acceptable for short tests specifically intended to collect initial diagnostic information. Concurrent validity studies indicated that LSP subscale scores were correlated with similar measures from the Group Embedded Figures Test, the Edmonds Learning Style Identification Exercise, and the Dunn, Dunn, and Price Learning styles Inventory (Keefe & Monk, 1990).

The self-report questionnaire

The self-report questionnaire (see Appendix B) developed by the researcher was designed to collect demographic and background data about the participants. The instrument consists of seven items related to (1) name, (2) grade, (3) gender, (4) computer literacy course (have taken or have never taken), (5) the amount of computer experience (1 week or less, more than 1 week to 1 month, more than 1 month to 6 months, more than 6 months to 1 year, more than 1 year), (6) software that the
participants ever used, and (7) Upward Bound Computer Science course (have taken or have never taken).

The Computer Attitude Scale (CAS)

The dependent variables (computer anxiety, computer confidence, and computer liking) were assessed with the Computer Attitude Scale (see Appendix C). The CAS was designed by Loyd and Gressard at the University of Virginia (1984). The scale has been widely used by researchers in numerous studies concerning attitudes toward learning about and using computers.

The CAS is a Likert-type instrument providing scores on three subscales corresponding to three affective dimensions: (1) Computer Anxiety, consisting of anxiety toward or fear of computers or learning to use computers; (2) Computer Confidence, related to confidence in the ability to learn about or use computers; (3) Computer Liking, meaning enjoyment or liking of computers and using computers. Alpha reliability coefficients were .87, .91, and .91 for each subscale, respectively.

Each subscale consists of ten items and presents positively and negatively worded statements such as "computers do not scare me at all" or "computers make me feel nervous and uncomfortable." The instrument employs a four-point scale in which students respond to the statements by selecting one of four responses (strongly agree, slightly agree, slightly disagree, strongly disagree). Scores on any subscale can range from 10 to 40. A score of 25 in each subscale indicates a neutral attitude toward computers. Higher scores on the Computer Anxiety subscale correspond to lower anxiety, while higher scores on the
Computer Confidence and Computer Liking subscales correspond to a greater degree of confidence and liking, respectively. The total score based upon these three subscales can be interpreted as presenting a general attitude toward computers.

Procedures

NASSP Learning Style Profile test scores for 77 students were obtained from Dr. Bobby Beavers, the director of the Upward Bound Program at Iowa State University. The LSP test was administered to students by Ms. Susan Robson in W142 Lagomarcino Hall, Iowa State University on March 20, 1993.

The Computer Attitude Scale instrument was administered to students after the researcher was granted permission from the Iowa State University Committee on the Rights of Human Subjects in Research (see Appendix D). Thirty-four students were administered the CAS by Ms. Melissa Turner, the coordinator of the Upward Pound Program, on May 22, 1993 at Iowa State University. The survey was distributed to students after explaining to them the purpose of the survey, informing them that releasing their responses was voluntary, and assuring them that their responses would be anonymous and confidential. Following this administration, the self-report questionnaires and the CAS instrument were mailed to the other 31 students who did not attend the meeting on May 22. Twenty-Four students returned the survey between May 28 and June 17. A total of 58 participants responded to both the self-report questionnaire and the Computer Attitude Scale.
Data Analysis

Data collected were coded and the information was entered into the mainframe computer of Iowa State University. The Statistical Package for the Social Sciences (SPSS) was used to analyze the data. T-tests were used to examine whether one or more of the cognitive styles were dominant within the total sample (77 Upward Bound students). Pearson zero-order correlation was used to determine whether gender was related to cognitive styles. Multiple linear regressions were used to test the effects of gender, computer experience, and cognitive styles on computer anxiety, computer confidence, and computer liking. The overall analyses incorporating the major elements (computer anxiety, computer confidence, computer liking, and the six NASSP cognitive styles) were based on three full models.

In the full model 1, computer anxiety served as the dependent variable, and gender, computer experience, computer literacy course, and six cognitive styles were the independent variables. The formula for the full model 1 is as follows:

Full Model 1

Computer Anxiety = \beta_1 \text{Gender} + \beta_2 \text{Computer experience} + \beta_3 \text{Computer Literacy Course} + \beta_4 \text{Analytic} + \beta_5 \text{Spatial} + \beta_6 \text{Discrimination} + \beta_7 \text{Categorization} + \beta_8 \text{Sequential} + \beta_9 \text{Memory}
In the full model 2, computer confidence served as the dependent variable, and gender, computer experience, computer literacy course, and six cognitive styles were the independent variables. The formula for the full model 2 is as follows:

**Full Model 2**

\[
\text{Computer Confidence} = \beta_1 \text{Gender} + \beta_2 \text{Computer experience} + \beta_3 \text{Computer Literacy Course} + \beta_4 \text{Analytic} + \beta_5 \text{Spatial} + \beta_6 \text{Discrimination} + \beta_7 \text{Categorization} + \beta_8 \text{Sequential} + \beta_9 \text{Memory}
\]

In the full model 3, computer liking served as the dependent variable, and gender, computer experience, computer literacy course, and six cognitive styles were the independent variables. The formula for the full model 3 is as follows:

**Full Model 3**

\[
\text{Computer Liking} = \beta_1 \text{Gender} + \beta_2 \text{Computer experience} + \beta_3 \text{Computer Literacy Course} + \beta_4 \text{Analytic} + \beta_5 \text{Spatial} + \beta_6 \text{Discrimination} + \beta_7 \text{Categorization} + \beta_8 \text{Sequential} + \beta_9 \text{Memory}
\]
CHAPTER 4. RESULTS

This chapter contains three major sections: (1) descriptive statistics on NASSP cognitive skills, computer anxiety, computer confidence, and computer liking; (2) testing the hypotheses; and (3) summary.

The data reported in this chapter were based on three instruments: (1) the NASSP Learning Style Profile; (2) the Computer Attitude Scale; and (3) the self-report questionnaire. The NASSP Learning Style Profile instrument accesses six cognitive skills: analytic, spatial, discrimination, categorization, sequential processing, and memory. The Computer Attitude Scale measures three elements: computer anxiety, computer confidence, and computer liking. In the self-report questionnaire the subjects were asked to estimate their computer experience as (1) 1 week or less; (2) more than 1 week to 1 month; (3) more than 1 month to 6 months; (4) more than 6 months to 1 year; and (5) more than 1 year. Seventy-seven subjects completed the Learning Style Profile test, but only 58 of the 77 subjects took the Computer Attitude Scale test and responded to the self-report questionnaires.

All of the statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS). In addition to describing the data using descriptive statistics, t-tests, Pearson zero-order correlation, and multiple linear regression were conducted to examine the research hypotheses. T-tests were used to explore the dominant cognitive style for the total sample. Correlations were used to determine whether gender was related to each cognitive style. Multiple linear regressions were used
to test the effects of gender, computer experience, and cognitive styles on computer anxiety, computer confidence, and computer liking.

**Description of the Data**

*Descriptive statistics on NASSP cognitive skills for the total sample of 77 students*

Six cognitive dimensions were measured by the NASSP Learning Style Profile. A standard score was calculated for each cognitive skill. The NASSP norm table (see Table 3) categorizes the standard scores using a scale of "weak," "average," and "strong." Scores below 40 in a given dimension represent a "weak" skill, scores 40 through 60 are "average," and scores above 60 are "strong" skill ratings. Each of these categories has high, middle, and low ranges. Thus there are nine categories: low-weak, middle-weak, high-weak, low-average, middle-average, high-average, low-strong, middle-strong, and high-strong.

The means, medians, modes, standard deviations, and ranges of the cognitive skill scores for the seventy-seven subjects are provided in Table 4. Additionally, the mean scores obtained from the sample were compared with NASSP norms (see Table 5 and Table 6).

<table>
<thead>
<tr>
<th>Table 3: NASSP norm table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scale</strong></td>
</tr>
<tr>
<td>Score</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table 4: Descriptive statistics on cognitive skills for the total sample

<table>
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<tr>
<th></th>
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<th>Median</th>
<th>Mode</th>
<th>SD</th>
<th>Range</th>
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</table>

Males = 37.  
Females = 40.  
SD = Standard Deviation.

Discrimi = Discrimination Skill.  
Categori = Categorization Skill.

Table 5 shows that the subjects' highest mean score (55) was in the spatial skill. On a scale of "weak", "average", and "strong", this skill was within the high-average range. The other five cognitive skills (analytic, discrimination, categorization, sequential processing, and memory) were within the mid-average range.
The females had higher mean scores than the males on analytic, discrimination and categorization skills, but had lower mean scores on spatial and memory skills. For both the males and the females, the mean scores on the sequential processing were the same. It is noteworthy that the spatial style was the dominant mode of processing information for both males (score 56) and females (score 55) in this study. However, the males had a low-average mean score (46) in the discrimination skill.

Table 5: Cognitive skill mean scores on the NASSP norm table

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<tr>
<th>Scale</th>
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<th>Average</th>
<th>Strong</th>
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<td>High</td>
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</tr>
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<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>49</td>
<td>52</td>
</tr>
<tr>
<td><strong>Spatial</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>56</td>
<td>55</td>
</tr>
<tr>
<td><strong>Discrimination</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
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</tr>
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<td>48</td>
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<td><strong>Categorization</strong></td>
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<td></td>
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<td>Total</td>
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<td>52</td>
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</tr>
<tr>
<td>Total</td>
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<td>50</td>
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<tr>
<td>Total</td>
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<td>50</td>
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</table>
Table 6 shows that, in general, the mean scores of the Upward Bound students in this study were similar to the NASSP norm group on five modes: analytic, discrimination, categorization, sequential processing, and memory skills. Of the six skills, only the spatial skill of the Upward Bound students was noticeably higher than NASSP norms.

Detailed statistics on the frequency and percentage of the six cognitive skill scores are presented in Table 7.

Table 6: Comparison of Upward Bound group and NASSP norm group on cognitive skills

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Upward Bound</th>
<th>NASSP Norms</th>
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<td></td>
<td>N = 77</td>
<td>N &gt; 3860</td>
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<tr>
<td>Analytic Skill</td>
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<td>50</td>
</tr>
<tr>
<td>Spatial Skill</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>Discrimination Skill</td>
<td>48</td>
<td>50</td>
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<tr>
<td>Categorization Skill</td>
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<td>50</td>
</tr>
<tr>
<td>Sequential Skill</td>
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<td>50</td>
</tr>
<tr>
<td>Memory Skill</td>
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<td>50</td>
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</tbody>
</table>


NASSP Norms = NASSP Learning Style Profile norm group for grades 6-12.
Table 7: Frequency and percentage of cognitive skill mean scores on the NASSP norm table for the total sample

<table>
<thead>
<tr>
<th>Scale</th>
<th>Weak</th>
<th>Average</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Mid</td>
<td>High</td>
</tr>
<tr>
<td>Score</td>
<td>&lt; 30</td>
<td>30-35</td>
<td>40</td>
</tr>
<tr>
<td>Analytic</td>
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</tr>
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</tr>
<tr>
<td>%</td>
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<td>3.9</td>
<td>10.4</td>
</tr>
<tr>
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</tr>
<tr>
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<td>2</td>
<td>2</td>
</tr>
<tr>
<td>%</td>
<td>0</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>Discrimination</td>
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</tr>
<tr>
<td>freq</td>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>6.5</td>
<td>2.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Categorization</td>
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</tr>
<tr>
<td>freq</td>
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<td>3</td>
<td>4</td>
</tr>
<tr>
<td>%</td>
<td>2.6</td>
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<tr>
<td>%</td>
<td>2.6</td>
<td>3.9</td>
<td>9.1</td>
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<tr>
<td>Memory</td>
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</tr>
<tr>
<td>freq</td>
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<td>3</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>3.9</td>
<td>3.9</td>
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</table>

N = 77 (males=37, females=40)
freq = frequency
Descriptive statistics on cognitive skills for 58 students, who took both the NASSP Learning Style Profile test and the Computer Attitude Scale test.

The data presented in Table 8 were used to relate to the Computer Attitude Scale scores. The cognitive skill scores were from 58 of the 77 subjects, who participated in both the NASSP Learning Style Profile test and the Computer Attitude Scale test. The highest mean score (55.55) of the 58 subjects was on the spatial skill, placing it in the high-average range. The categorization skill also was in the high-average range. The analytic, discrimination, categorization, sequential processing, and memory skills were in the middle-average range.

Descriptive statistics on the Computer Attitude Scale

The means, medians, modes, standard deviations, and ranges of computer attitude (anxiety, confidence, liking) scores are shown in Table 9. Male group means were a little higher than female group means in two of the three subscales (computer confidence, computer liking) except computer anxiety. On all three subscales of the Computer Attitude Scale, the mean scores for the 58 subjects ranged from 31 to 34 on a 40-point scale where a score of 25 would indicate a neutral attitude toward computers. In general, the results suggested that the Upward Bound students as a whole had fairly positive attitudes toward computers.
Table 8: Descriptive statistics on cognitive skills for the 58 subjects, who took both the NASSP Learning Style Profile and the Computer Attitude Scale tests

<table>
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<td>Mode</td>
<td>SD</td>
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Males = 29.
Females = 29.
SD = Standard Deviation.
Discrimi = Discrimination Skill.
Categori = Categorization Skill.
Table 9: Descriptive statistics on scores of the Computer Attitude Scale

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<td>40</td>
<td>5.44</td>
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<td>40</td>
<td>6.71</td>
<td>20</td>
</tr>
<tr>
<td>Female</td>
<td>30.17</td>
<td>30</td>
<td>30</td>
<td>6.54</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>30.69</td>
<td>31</td>
<td>40</td>
<td>6.59</td>
<td>25</td>
</tr>
</tbody>
</table>

aThe higher the score, the less computer anxiety the individual has.

bThe higher the score, the more computer confidence the individual has.

cThe higher the score, the more the individual likes computers.

Males = 29.

Females = 29.

SD = Standard Deviation.
Testing the Hypotheses

Related to Question 1: Are one or more of the six dimensions of the NASSP cognitive styles dominant within the Upward Bound students?

Hypothesis 1: One or more of the NASSP cognitive styles are dominant within the Upward Bound students.

In order to test Hypothesis 1, fifteen paired t-tests were conducted (see Table 10). Results indicate that the subjects had a significantly higher mean score on the spatial skill than on analytic, discrimination, categorization, sequential processing, and memory skills (p = .000, p = .000, p = .006, p = .000, p = .001, respectively). Therefore, Hypothesis 1 failed to be rejected. This finding suggests that the Upward Bound students of the current study tended to have the spatial style preference.

Table 10: Fifteen t-tests for six cognitive dimensions of the NASSP Learning Style Profile

<table>
<thead>
<tr>
<th>Ana</th>
<th>Spa</th>
<th>N=77</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ana</td>
</tr>
<tr>
<td>Spa</td>
<td>T=</td>
<td>-4.12</td>
</tr>
<tr>
<td></td>
<td>p=</td>
<td>(.000)**</td>
</tr>
<tr>
<td>Dis</td>
<td>1.92</td>
<td>5.42</td>
</tr>
<tr>
<td></td>
<td>(.058)</td>
<td>(.000)**</td>
</tr>
<tr>
<td>Cat</td>
<td>-.69</td>
<td>2.81</td>
</tr>
<tr>
<td></td>
<td>(.494)</td>
<td>(.006)*</td>
</tr>
<tr>
<td>Seq</td>
<td>.28</td>
<td>4.45</td>
</tr>
<tr>
<td></td>
<td>(.784)</td>
<td>(.000)**</td>
</tr>
<tr>
<td>Mem</td>
<td>.14</td>
<td>3.55</td>
</tr>
<tr>
<td></td>
<td>(.889)</td>
<td>(.001)*</td>
</tr>
</tbody>
</table>

T = t-ratios.  
p = p-value.  
* Significant at .01 level.  
** Significant at .001 level.

Ana = Analytic Skill.  
Spa = Spatial Skill.  
Dis = Discrimination Skill.  
Cat = Categorization Skill.  
Seq = Sequential Skill.  
Mem = Memory Skill.
Related to Question 2: Are there relationships between gender and cognitive styles?

Hypothesis 2: There are significant relationships between gender and cognitive styles.

Hypothesis 2 pertains to the relationships between gender and cognitive styles. Because there are six elements of cognitive styles, each element is examined as a subhypothesis (Hypothesis 2.1 through 2.6).

Hypothesis 2.1: There is a significant relationship between gender and the analytic cognitive style.

Hypothesis 2.2: There is a significant relationship between gender and the spatial cognitive style.

Hypothesis 2.3: There is a significant relationship between gender and the discrimination cognitive style.

Hypothesis 2.4: There is a significant relationship between gender and the categorization cognitive style.

Hypothesis 2.5: There is a significant relationship between gender and the sequential processing cognitive style.

Hypothesis 2.6: There is a significant relationship between gender and the memory cognitive style.
Pearson zero-order correlations were used to test Hypothesis 2.1 through Hypothesis 2.6. Table 11 shows that of the six cognitive styles, only the discrimination mode was significantly related to gender at the .1 level (r = .20, p = .09). This finding indicates that female subjects had a stronger discrimination style than male subjects. However, there were no significant differences in the other five cognitive styles between males and females in the sample. Therefore, only Hypothesis 2.3 failed to be rejected.

Related to Question 3: What are the effects of gender, computer experience, and cognitive styles on computer anxiety?

Hypothesis 3 through Hypothesis 5 all were tested by multiple linear regressions. These hypotheses were all based on the full model 1 (described in Chapter 3).

Table 11: Correlation between gender and each cognitive style for the total sample

<table>
<thead>
<tr>
<th>Gender</th>
<th>N=77</th>
<th>Ana</th>
<th>Spa</th>
<th>Dis</th>
<th>Cat</th>
<th>Seq</th>
<th>Mem</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td></td>
<td>.12</td>
<td>-.11</td>
<td>.20</td>
<td>.03</td>
<td>.02</td>
<td>-.05</td>
</tr>
<tr>
<td>p - value</td>
<td>.29</td>
<td>.36</td>
<td>.09*</td>
<td>.80</td>
<td>.85</td>
<td>.64</td>
<td></td>
</tr>
</tbody>
</table>

r = Pearson correlation coefficient.  
* Significant at .1 level.  
Ana = Analytic Skill.  
Spa = Spatial Skill.  
Dis = Discrimination Skill.  
Cat = Categorization Skill.  
Seq = Sequential Processing Skill.  
Mem = Memory Skill.
Hypothesis 3: Gender contributes significantly to the variance in computer anxiety after controlling for computer experience, computer literacy course, and cognitive styles.

The results shown in Table 12 indicate that gender was not a significant predictor of computer anxiety in the full model 1 ($\beta = .15, p = .27$). The finding of the present study implies gender did not contribute significantly to the variance in computer anxiety after controlling for computer experience, computer literacy course, and each cognitive style. Thus, Hypothesis 3 was rejected. Nevertheless, it is noteworthy that a combination of the nine independent variables in the full model 1 contributes significantly to approximately 32% of the variance in computer anxiety ($R^2 = .32, p = .02$, see Table 12). The regression equation for the full model 1 is as follows:

**Full Model 1**

Computer Anxiety = .15 Gender - .36 Computer Experience
- .07 Computer Literacy Course - .28 Analytic
+ .03 Spatial - .03 Discrimination
- .06 Categorization - .21 Sequential + .28 Memory
Table 12: Summary of multiple linear regression models for the analysis of variance in computer anxiety

<table>
<thead>
<tr>
<th>Model/Variables in equation</th>
<th>$R^2$</th>
<th>$F$</th>
<th>Beta</th>
<th>T</th>
<th>p - value</th>
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</thead>
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<td>.02*</td>
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<td>1.11</td>
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<td></td>
</tr>
<tr>
<td>CE</td>
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<td>-2.40</td>
<td>.02*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLC</td>
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<td>- .50</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Analytic Skill</td>
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<td>-2.10</td>
<td>.04*</td>
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<td></td>
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<tr>
<td>Spatial Skill</td>
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<td>.21</td>
<td>.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discrimi Skill</td>
<td>-.03</td>
<td>- .27</td>
<td>.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Categori Skill</td>
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<td>- .48</td>
<td>.63</td>
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<td></td>
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<td>Sequential Skill</td>
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<td>-1.58</td>
<td>.12</td>
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<td>2.20</td>
<td>.03*</td>
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<td>.07</td>
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<tr>
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</tr>
<tr>
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<td>- .13</td>
<td>.90</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>-1.10</td>
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<td>Sequential Skill</td>
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<td>.20</td>
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<td>Memory Skill</td>
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<td>1.90</td>
<td>.06</td>
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<td>.01</td>
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<td>CLC</td>
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<td>- .42</td>
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<td>- .48</td>
<td>.63</td>
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<tr>
<td>reduced model 3</td>
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<td>2.10</td>
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<td>.05</td>
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<tr>
<td>Gender</td>
<td>.09</td>
<td>.64</td>
<td>.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE</td>
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<td>-2.13</td>
<td>.04</td>
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<td></td>
</tr>
<tr>
<td>CLC</td>
<td>-.07</td>
<td>- .46</td>
<td>.64</td>
<td></td>
<td></td>
</tr>
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<td>Analytic Skill</td>
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<td>-1.71</td>
<td>.09</td>
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<td>1.00</td>
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<td>.83</td>
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<tr>
<td>Categori Skill</td>
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<td>- .40</td>
<td>.69</td>
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<td></td>
</tr>
<tr>
<td>Sequential Skill</td>
<td>-.15</td>
<td>-1.10</td>
<td>.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R^2$ = the amount of variance accounted for by the model.
N= 58 (males=29, females=29).
Beta = standardized regression coefficient.
T = t-ratios.

* Significant at .05 level.
CE = Computer Experience.
CLC = Computer Literacy Course.
Categori Skill = Categorization Skill.
Discrimi Skill = Discrimination Skill.
Hypothesis 4: Computer experience contributes significantly to the variance in computer anxiety after controlling for gender, computer literacy course, and cognitive styles.

The results derived from the estimation of the full model 1 indicate that computer experience was significant at the .05 level in predicting computer anxiety ($\beta = -.36$, $p = .02$, see Table 12). Thus, Hypothesis 4 failed to be rejected. This negative relationship between computer experience and computer anxiety revealed that the more computer experience students had, the less computer anxiety they had.

Furthermore, the reduced model 1 was developed to examine the proportion of the variance in computer anxiety accounted for by computer experience. It included the variables of the full model 1 except computer experience. In comparing the squared multiple correlations ($R^2$) of the full model 1 and the reduced model 1, it was noted that $R^2$ decreased from .32 to .24 (see Table 12). This finding suggests that computer experience accounted for 8% of the variance in computer anxiety. The regression equation for the reduced model 1 is as follows:

**Reduced Model 1**

Computer Anxiety = .07 Gender - .21 Computer Literacy Course
- .35 Analytic + .06 Spatial - .02 Discrimination
- .14 Categorization - .18 Sequential + .26 Memory
Hypothesis 5: Cognitive styles contribute significantly to the variance in computer anxiety.

Hypothesis 5 pertains to the effects of cognitive styles on computer anxiety. Because there are six elements of cognitive styles, each element is examined as a subhypothesis (Hypothesis 5.1 through 5.6).

Hypothesis 5.1: The **analytic** cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 5.2: The **spatial** cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 5.3: The **discrimination** cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 5.4: The **categorization** cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 5.5: The **sequential processing** cognitive style contributes significantly to the variance in computer anxiety after
controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

**Hypothesis 5.6:** The memory cognitive style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

As shown in Table 12, at the .05 level, two of the six cognitive styles (analytic and memory) are significant predictors of computer anxiety ($\beta = -.28, p = .04; \beta = .28, p = .03$, respectively). Therefore, only Hypothesis 5.1 and Hypothesis 5.6 failed to be rejected.

The negative relationship between the analytic style and computer anxiety means that students with stronger analytic style preferences tended to have less computer anxiety. In contrast, the positive relationship between the memory style and computer anxiety implies that students with stronger memory style preferences tended to have more computer anxiety.

Additionally, the **reduced model 2** was developed to determine the proportion of the variance in computer anxiety accounted for by the analytic style. It included the variables of the **full model 1** except the analytic style. Also, the **reduced model 3** was conducted to determine the proportion of the variance in computer anxiety accounted for by the memory style. It contained the variables of the **full model 1** except the memory style.

In comparing the squared multiple correlations ($R^2$) of the **full model 1** and the **reduced model 2**, it was noted that $R^2$ decreased from
.32 to .26 (see Table 12). This finding suggests that analytic style accounted for 6% of the variance in computer anxiety. Similarly, in comparing the squared multiple correlations ($R^2$) of the full model 1 and the reduced model 3, it was noted that $R^2$ decreased from .32 to .26 (see Table 12). This finding suggests that memory style accounted for 6% of the variance in computer anxiety.

The regression equations for the reduced model 2 and the reduced model 3 are as follows:

**Reduced Model 2**

Computer Anxiety = .11 Gender - .43 computer experience
- .06 Computer Literacy Course - .06 Spatial
- .06 Discrimination - .06 Categorization
- .21 Sequential + .24 Memory

**Reduced Model 3**

Computer Anxiety = .09 Gender - .34 Computer Experience
- .07 Computer Literacy Course - .24 Analytic
+ (7.51E-04) Spatial + .03 Discrimination
- .05 Categorization - .15 Sequential
Related to Question 4: What are the effects of gender, computer experience, and cognitive styles on computer confidence?

Hypothesis 6 through Hypothesis 8 all were tested by multiple linear regressions. These hypotheses were all based on the full model 2 (described in Chapter 3).

Hypothesis 6: Gender contributes significantly to the variance in computer confidence after controlling for computer experience, computer literacy course, and cognitive styles.

Table 13 shows that gender was not significantly predictive of computer confidence in the full model 2 (β = -0.18, p = 0.23), while female subjects had less computer confidence than male subjects. Therefore, Hypothesis 6 was rejected. The regression equation for the full model 2 is as follows:

**Full Model 2**

Computer Confidence = -0.18 Gender + 0.23 Computer Experience
+ 0.01 Computer Literacy Course + 0.17 Analytic
+ 0.11 Spatial - 0.01 Discrimination
- 0.02 Categorization - 0.01 Sequential
- 0.12 Memory
Table 13: Summary of the full model 2 for the analysis of variance in computer confidence

<table>
<thead>
<tr>
<th>Model/Variables in equation</th>
<th>R²</th>
<th>F</th>
<th>Beta</th>
<th>T</th>
<th>p - value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full model 2</td>
<td>.13</td>
<td>.79</td>
<td>- .18</td>
<td>-1.22</td>
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<tr>
<td>CE</td>
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<td></td>
<td>.01</td>
<td>.06</td>
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<td>.11</td>
<td>.75</td>
<td>.46</td>
</tr>
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<td>Spatial Skill</td>
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<td>-.01</td>
<td>-.10</td>
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<td>Discrimi Skill</td>
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<td>-.11</td>
<td>.91</td>
</tr>
<tr>
<td>Categori Skill</td>
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<td></td>
<td>.01</td>
<td>.05</td>
<td>.96</td>
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<tr>
<td>Sequential Skill</td>
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<td></td>
<td>-.12</td>
<td>-.83</td>
<td>.41</td>
</tr>
</tbody>
</table>

R² = the amount of variance accounted for by the model.  CE = Computer Experience. Beta = standardized regression coefficient. CLC = Computer Literacy Course. Categori Skill = Categorization Skill. Discrimi Skill = Discrimination Skill.

Hypothesis 7: Computer experience contributes significantly to the variance in computer confidence after controlling for gender, computer literacy course, and cognitive styles.

The result presented in Table 13 indicates that computer experience was not significant in predicting computer confidence after controlling for gender, computer literacy course, and each cognitive style (β = .23, p = .19). Therefore, Hypothesis 7 was rejected.
Hypothesis 8: Cognitive styles contribute significantly to the variance in computer confidence.

Hypothesis 8 pertains to the effects of cognitive styles on computer confidence. Because there are six elements of cognitive styles, each element is examined as a subhypothesis (Hypothesis 8.1 through 8.6).

Hypothesis 8.1: The analytic cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 8.2: The spatial cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 8.3: The discrimination cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 8.4: The categorization cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.
Hypothesis 8.5: The sequential processing cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 8.6: The memory cognitive style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Table 13 shows that each cognitive style did not contribute significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles. Therefore, Hypothesis 8.1 through 8.6 all were rejected.

Related to Question 5: What are the effects of gender, computer experience, and cognitive styles on computer liking?

Hypothesis 9 through Hypothesis 11 all were tested by multiple linear regressions. These hypotheses were all based on the full model 3 (described in Chapter 3).

Hypothesis 9: Gender contributes significantly to the variance in computer liking after controlling for computer experience, computer literacy course, and cognitive styles.
Table 14 shows that gender was not a significant predictor of computer liking after controlling for computer experience, computer literacy course, and cognitive styles ($\beta = -.15$, $p = .30$). Therefore, Hypothesis 9 was rejected.

Table 14: Summary of multiple linear regression models for the analysis of variance in computer liking

<table>
<thead>
<tr>
<th>Model/Variables in equation</th>
<th>$R^2$</th>
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<th>Beta</th>
<th>$T$</th>
<th>$p$ - value</th>
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<td>CE</td>
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<td>- .48</td>
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<td>-.04</td>
<td>-.27</td>
<td>.79</td>
</tr>
<tr>
<td>CLC</td>
<td></td>
<td></td>
<td>.30</td>
<td>2.08</td>
<td>.04</td>
</tr>
<tr>
<td>Analytic Skill</td>
<td></td>
<td></td>
<td>.03</td>
<td>.24</td>
<td>.81</td>
</tr>
<tr>
<td>Discrimi Skill</td>
<td></td>
<td></td>
<td>.09</td>
<td>.62</td>
<td>.54</td>
</tr>
<tr>
<td>Categori Skill</td>
<td></td>
<td></td>
<td>.13</td>
<td>.89</td>
<td>.38</td>
</tr>
<tr>
<td>Sequential Skill</td>
<td></td>
<td></td>
<td>-.21</td>
<td>1.44</td>
<td>.16</td>
</tr>
</tbody>
</table>

$R^2 =$ the amount of variance accounted for by the model. 
Beta = standardized regression coefficient. 
$T =$ t-ratios. 
* Significant at .1 level. 
CE = Computer Experience. 
CLC = Computer Literacy Course. 
Discrimi Skill = Discrimination Skill. 
Categori Skill = Categorization Skill.
The regression equation for the full model 3 is as follows:

**Full Model 3**

Computer Liking = - .15 Gender + .02 Computer Experience  
- .07 Computer Literacy Course + .20 Analytic  
+ .28 Spatial + .07 Discrimination  
+ .08 Categorization + .05 Sequential - .18 Memory

**Hypothesis 10:** Computer experience contributes significantly to the variance in computer liking after controlling for gender, computer literacy course, and cognitive styles.

As shown in Table 14, computer experience was not a significant predictor of computer liking after controlling for gender, computer literacy course, and cognitive styles ($\beta = .02, p = .30$). Therefore, Hypothesis 10 was rejected.

**Hypothesis 11:** Cognitive styles contribute significantly to the variance in computer liking.

Hypothesis 11 pertains to the effects of cognitive styles on computer liking. Because there are six elements of cognitive styles, each element is examined as a subhypothesis (Hypothesis 11.1 through 11.6).

**Hypothesis 11.1:** The analytic cognitive style contributes significantly to the variance in computer liking after controlling for
gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 11.2: The spatial cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 11.3: The discrimination cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 11.4: The categorization cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 11.5: The sequential processing cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

Hypothesis 11.6: The memory cognitive style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.

As shown in Table 14, of the six cognitive styles, only the spatial style accounted for a significant amount of the variance in predicting computer liking ($\beta = .28$, $p = .06$). Therefore, only Hypothesis 11.2 failed
to be rejected. This positive relationship between the spatial style and computer liking implies that the more spatial style preference subjects had, the more they liked computers.

Furthermore, the reduced model 4 was made to examine the proportion of the variance in computer liking accounted for by the spatial style. It included the variables of the full model 3 except the spatial style. In comparing the squared multiple correlations ($R^2$) of the full model 3 and the reduced model 4, it was noted that $R^2$ decreased from .19 to .13 (see Table 14). The finding indicates that the spatial style accounted for 6% of the variance in computer liking. The regression equation for the reduced model 4 is as follows:

**Reduced Model 4**

\[
\text{Computer Liking} = -0.17 \text{ Gender} - 0.01 \text{ Computer Experience} - 0.04 \text{ Computer Literacy Course} - 0.30 \text{ Analytic} + 0.03 \text{ Discrimination} + 0.09 \text{ Categorization} + 0.13 \text{ Sequential} - 0.21 \text{ Memory}
\]

**Summary**

The results of this study related to eleven proposed hypotheses (three of which were divided into six parts) were summarized in Table 15.
Table 15: Summary of the results of hypotheses

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Method</th>
<th>Fail to reject</th>
<th>Reject</th>
<th>significant level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: One or more of the NASSP cognitive styles are dominant within the Upward Bound students.</td>
<td>t-tests</td>
<td>*</td>
<td></td>
<td>.01</td>
</tr>
<tr>
<td>2.1: There is a significant relationship between gender and the analytic cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>2.2: There is a significant relationship between gender and the spatial cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>2.3: There is a significant relationship between gender and the discrimination cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td>.1</td>
</tr>
<tr>
<td>2.4: There is a significant relationship between gender and the categorization cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>2.5: There is a significant relationship between gender and the sequential processing cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>2.6: There is a significant relationship between gender and the memory cognitive style.</td>
<td>correlation</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>3: Gender contributes significantly to the variance in computer anxiety after controlling for computer experience, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>4: Computer experience contributes significantly to the variance in computer anxiety after controlling for gender, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td>.05</td>
</tr>
<tr>
<td>5.1: The analytic style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td>.05</td>
</tr>
</tbody>
</table>
### Table 15 (continued)

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Method</th>
<th>Fail to reject</th>
<th>Reject</th>
<th>Significant level</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2: The spatial style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>5.3: The discrimination style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>5.4: The categorization style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>5.5: The sequential style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>5.6: The memory style contributes significantly to the variance in computer anxiety after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td>.05</td>
</tr>
<tr>
<td>6: Gender contributes significantly to the variance in computer confidence after controlling for computer experience, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>7: computer experience contributes significantly to the variance in computer confidence after controlling for gender, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8.1: The analytic style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Hypotheses</td>
<td>Method</td>
<td>Fail to reject</td>
<td>Reject</td>
<td>Significant level</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>----------------</td>
<td>--------</td>
<td>-------------------</td>
</tr>
<tr>
<td>8.2: The spatial style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8.3: The discrimination style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8.4: The categorization style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8.5: The sequential style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>8.6: The memory style contributes significantly to the variance in computer confidence after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>9: Gender contributes significantly to the variance in computer liking after controlling for computer experience, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>10: Computer experience contributes significantly to the variance in computer liking after controlling for gender, computer literacy course, and cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>11.1: The analytic style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
Table 15 (continued)

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Method</th>
<th>Fail to reject</th>
<th>Reject</th>
<th>significant level</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.2: The spatial style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td>.1</td>
</tr>
<tr>
<td>11.3: The discrimination style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.4: The categorization style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.5: The sequential style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.6: The memory style contributes significantly to the variance in computer liking after controlling for gender, computer experience, computer literacy course, and the other cognitive styles.</td>
<td>multiple regression</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5. DISCUSSION

This chapter is divided into four sections: (1) a brief summary of the study; (2) discussion of the findings; (3) implications of the findings; and (4) recommendations for further research.

Summary of the Study

Each learner possesses typical modes of perception, organization, and retention that are distinctive and consistent. These characteristic differences are called cognitive styles. Understanding students' cognitive styles is one of the first steps to providing an effective education. In addition, the rapid growth of computer utilization in schools and society makes it vital to understand students' attitudes toward computers and to investigate possible determinants of attitudes toward computers.

The purpose of the study was: (1) to identify the cognitive styles of Upward Bound students, (2) to explore the relationships between gender and students' cognitive styles, and (3) to investigate the effects of gender, the amount of computer experience, and cognitive styles on Upward Bound students' attitudes (anxiety, confidence, and liking) toward computers.

The instruments used in the current study included: (1) the NASSP Learning Style Profile, (2) the Computer Attitude Scale, and (3) the self-report questionnaire. Six dimensions of cognitive styles (analytic, spatial, discrimination, categorization, sequential processing, and memory) were measured by the NASSP Learning Style Profile. These dimensions
signified a person's general approach to processing information. Student attitudes toward working with or learning about computers including computer anxiety, computer confidence, and computer liking were assessed by the Computer Attitude Scale.

The population consisted of 77 eighth through twelfth graders enrolled in the 1993 Upward Bound Program at Iowa State University. The data for exploring the relationship between gender and cognitive style were based on the responses of all 77 subjects, who took the NASSP Learning Style Profile test. On the other hand, the data for investigating the effects of gender, computer experience, and cognitive styles on attitudes toward computers were based on the responses of 58 of the 77 subjects, who participated in all the NASSP Learning Style Profile, the Computer Attitude Scale, and the self-report questionnaire surveys.

The statistical analyses were conducted using the SPSS computer software. The description of subjects was based on results of descriptive statistics. In addition, t-tests, Pearson one-order correlations, and multiple linear regressions were used to examine the research hypotheses. Eleven hypotheses were developed, three of which were divided into six parts. A summary of the findings revealed the following:

**Related to Research Question 1:**

**Are one or more of the six dimensions of the NASSP cognitive styles dominant within the Upward Bound students?**

- Spatial style was dominant within the Upward Bound students.
Related to Research Question 2:

Are there relationship between gender and cognitive styles?

- At the .1 level, there was a significant relationship between gender and discrimination style with the males having weaker discrimination style preferences than the females.
- There was no significant relationships between gender and analytic, spatial, categorization, sequential processing, and memory styles.

Related to Research Question 3:

What are the effects of gender, computer experience, and cognitive styles on computer anxiety?

- At the .05 level, computer experience and analytic style were significant negative predictors of computer anxiety.
- At the .05 level, memory style was a significant positive predictor of computer anxiety.
- Gender, spatial style, discrimination style, categorization style, and sequential processing style were not significant predictors of computer anxiety.

Related to Research Question 4:

What are the effects of gender, computer experience, and cognitive styles on computer confidence?
• Gender, computer experience, and cognitive styles (analytic, spatial, discrimination, categorization, sequential processing, and memory) were not significant predictors of computer confidence.

**Related to Research Question 5:**

**What are the effects of gender, computer experience, and cognitive styles on computer liking?**

• At the .1 level, spatial style was a significant positive predictor of computer liking.

• Gender, computer experience, analytic style, discrimination style, categorization style, sequential processing style, and memory style, were not significant predictors of computer liking.

**Discussion of the Findings**

**Cognitive Style**

In the current study, the spatial mean score (55) of the Upward Bound students was in the high-average range on the NASSP norm scale; the mean scores of analytic, discrimination, categorization, sequential processing, and memory subscales were in the middle-average range. T-tests showed that the mean score of the spatial subscale was significantly higher than the mean scores of the other five cognitive subscales. This finding suggested that the spatial cognitive style was dominant within the Upward Bound students in this study, that is, these students tended to visualize an object from different perspectives. They
see key elements when objects are represented spatially and are able to recognize these same elements in different settings.

A comparison between the Upward Bound students and the NASSP norms (grades 6-12) revealed their cognitive skills were similar in the following five dimensions: (1) analytic, (2) discrimination, (3) categorization, (4) sequential processing, and (5) memory. However, the spatial skill of the Upward Bound students was noticeably higher than the NASSP norms (see table 6). It is worthy of further research to investigate what factors contribute to the cognitive difference on the spatial dimension between non-Upward Bound students and the Upward Bound students.

Of the six NASSP cognitive elements, only the discrimination dimension was significantly related to gender at the .1 level. The males were found to have a significantly lower mean score on the discrimination dimension. This finding suggests that males subjects had weaker discrimination style preferences and were less able to focus attention on the important elements of a task and to avoid distraction than female subjects.

A possible explanation for this finding is that biological factors -- genetic, hormonal, or neurological -- may play a role in gender differences in cognitive functioning. Another plausible explanation is that gender interacts with cultural background (Kogan, 1974).

Previous studies have also indicated that there were significant gender differences in cognitive styles (Carland, & Carland, 1990; Demick, 1991; Tucker, 1983). Because the cognitive styles in the current study
and in the previous studies were defined with different constructs and measured with inconsistent instruments, additional studies are needed to replicate the present study with the same NASSP Learning Style Profile and with a larger sample size.

**Computer Attitudes**

In general, the Upward Bound students as a whole had fairly positive attitudes toward computers. On all three subscales (anxiety, confidence, liking) of the Computer Attitude Scale, the mean scores ranged from 31 to 34 on a 40-point scale where a score of 25 would indicate a neutral attitude toward computers.

The results of this study show that there were no significant gender effects on computer anxiety, computer confidence, and computer liking after controlling for amount of computer experience, computer literacy courses, and cognitive styles. The lack of significant gender effects on computer attitudes reveals that females may be as confident and interested as males in computers, and that females do not necessarily have more anxiety toward working with or learning about computers than males. The findings support the results of some previous studies (Koohang, 1989; Loyd & Gressard, 1984; Pope-Davis & Twing, 1991), but conflict with the findings of Chen (1986) that males had less anxiety and more confidence in computers than females and the findings of Loyd et al. (1987) that males had more computer anxiety and liked computers less than females.

In the present study, the best predictor of computer anxiety is the amount of computer experience. Subjects with more computer
experience expressed less anxiety toward computers. This finding is consistent with the findings of earlier studies (Loyd & Gressard, 1984; Loyd et al., 1987; Okebukola et al., 1991-1992). A reasonable explanation for computer experience affecting computer anxiety is that more computer experience may allow students to be more familiar with computers and to feel less confused about computing, thus reducing their anxiety.

In earlier studies (Loyd & Gressard, 1984; Loyd et al., 1987; Okebukola et al., 1991-1992), more computer experience was found to have significant positive relationships to computer confidence and computer liking. In contrast, the present study shows that computer experience was not a significant predictor of computer confidence and computer liking. However, this lack of significant findings does not represent a direct contradiction of what previous research has indicated, because the $\beta$ values (although not statistically significant) do show an increase in positive attitudes for confidence and liking with an increase in amount of experience.

Also, analytic style was found to be a significant negative predictor of computer anxiety. In other words, students with stronger analytic style preferences tended to have less computer anxiety. A possible explanation for the finding is that students' experiences with computers could be predominantly from math and science courses where analytic skills were important, therefore, students with stronger analytic skills could match their cognitive style to the learning demands of the subject matter, accordingly they had less computer anxiety.
On the other hand, the study indicates analytic style did not contribute significantly to the variance in computer confidence and computer liking. The outcomes are different from the findings of Connell (1991) who found analytic style was positively related with students' attitudes toward computers.

Surprisingly, the present study shows that memory style was a significant positive predictor of computer anxiety, meaning that students with stronger memory style preferences tended to be more anxious toward computers. However, Frey (1989), investigating the influence of cognitive styles on college students' attitudes toward a hypermedia program, found no significant relationships between memory skill and pre-anxiety. The positive relationship between memory style and computer anxiety found in this study needs further validation with a larger, randomly selected sample. On the other hand, the study shows that memory style did not contribute significantly to the variance in computer confidence and computer liking.

Since some evidence linked spatial skill with success in aspects of math and technical courses (Keefe, 1988), it was predicted spatial style was the determinant of computer attitudes in all three subscales. Nevertheless, spatial style was found to be a significant predictor only in the computer liking subscale. This finding reveals students with stronger spatial style preferences tended to like to learn about or work with computers more.

Finally, the current study indicates the other three cognitive dimensions (discrimination, categorization, and sequential processing)
were not significant predictors of computer anxiety, computer confidence, computer liking. In other words, student attitudes toward computers were not significantly influenced by the three cognitive styles.

Since computer experience, computer literacy course, and six NASSP cognitive styles only accounted for 32% of the variance in computer anxiety in the full model 1, for 13% of the variance in computer confidence in the full model 2, and for 19% of the variance in computer liking in the full model 3, it seems to have other essential factors which were not examined in these models. Therefore, there appears to be a need for future research to investigate the other possible factors (e.g., teacher's personality, the type of computer use, social context, socioeconomic status, course subjects) accounting for students' attitudes toward computers.

Implications

In general, the Upward Bound students in the current study had the highest mean score on the spatial dimension of the NASSP cognitive styles. Spatial skill was related to success in art, architecture, mathematics, geography, chemistry, physics, technical courses (engineering, drafting, shop), and related occupations (Keefe, 1988). Beavers (1992) also found there was a significantly positive relationship between the spatial skills of Upward Bound students and their academic performance in math. Thus, it is proper for the Upward Bound students with spatial style preferences to select one or more of the above fields to be their majors or vocations. In addition, because spatial style
preference was dominant within the Upward Bound students, it is more effective with them to present new and difficult material in a spatial, visual mode rather than a verbal mode. However, the needs of the minority students with other different cognitive style preferences cannot be ignored.

Males in the current study had a significantly lower mean score (46) on the discrimination dimension than females (score 49). While the male mean score was in the "low-average" range, it appeared that male subjects had a little difficulty in attending to important elements of a task and in ignoring distractions such as air conditioners, hallway noises, someone tapping a pencil, and thoughts about lunch. Therefore, instructors in the Upward Bound Program should note gender differences in discrimination skills and give more guidance to males who need efficient focusing of attention to improve performance on relevant information and reduce interference from irrelevant information.

As was mentioned earlier, spatial style was found to be dominant within the Upward Bound students. Also, this study shows students with stronger spatial style preferences tended to be more interested in learning about or working with computers. Moreover, the Upward Bound students as a whole had fairly positive attitudes toward computers. Therefore, it is suitable for Upward Bound instructors to incorporate computer-based instruction into their teaching strategies.

Based on the findings, the information of students' previous computer experiences and cognitive styles may be more useful than gender background in both helping to understand students' attitudes
toward computers and in designing educational programs that involve computers.

Previous computer experience may be a critical factor with respect to computer anxiety. More computer experience leading to less computer anxiety suggests that computer experience be provided as early as possible. Therefore, Upward Bound should provide participants more opportunities to work with or learn about computers and encourage them to take the Upward Bound Computer Science course.

Furthermore, instructors need to be aware of cognitive style differences in students' attitudes toward computers. In this study, students who had weaker analytic style preferences or stronger memory style preferences tended to have more computer anxiety. These students' anxiety toward computers may negatively affect their performance, so instructors should give them assistance or guidance to overcome their anxiety rather than tease or scold them.

Recommendations for Further Research

After reviewing the findings, discussions, and implications, several recommendations for further research are raised:

1. The study could be replicated using all 24 subscales of the NASSP Learning Style Profile.

2. Research could be conducted to investigate the relationships between socioeconomic status and cognitive style preferences.
3. Research could be conducted to explore the relationships between cultural background (African-American, Asian-American, Caucasian-American, Hispanic-American, Native-American) and cognitive style preferences.

4. Research could be conducted to investigate possible factors that account for the gender difference in cognitive style.

5. Research could be conducted to explore if Upward Bound students improve their academic achievement and attitudes after they are taught through their preferred cognitive styles.

6. A longitudinal study could be conducted to explore the effects of cognitive style preferences of Upward Bound students on their educational-vocational choices.

7. Research could be conducted to investigate other possible factors accounting for differences in the attitudes of Upward Bound students toward computers, for example, the type of computer use (e.g., drill, tutorials, simulations, word processing, data bases, programming, telecommunications), course subjects, and social context.

8. Research could be conducted to explore the effects of different types of computer use on the academic achievements of Upward Bound students in computer-related courses.
BIBLIOGRAPHY


DeBello, T. C. (1989). *Comparison of eleven major learning styles models: Variables; appropriate populations; validity of instrumentation; and the research behind them*. Paper presented at the National Conference of the Association for Supervision and Curriculum Development, Orlando, FL. (ERIC Document Reproduction Service No. ED 312 093)


achievement. Doctoral dissertation, Iowa State University, Ames, IA.


APPENDIX A - 1.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF ANALYTIC SKILL
1. One of the forms below is hidden in the complex figure. The hidden form is the same size, same shape, and facing the same way as one of the forms below. Select the correct hidden form.

Simple Forms

A.  
B.  
C.  

Complex Figure

How many triangles can you find in the shapes below?

2.  

A. 4  B. 5  C. 6  D. 7  E. 8

3.  

A. 4  B. 5  C. 10  D. 12  E. 16
APPENDIX A - 2.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF SPATIAL SKILL
8. A piece of paper has been folded in the following ways. The star (*) shows where a part was cut out.

Which picture shows how the paper will look when it is unfolded?

A. B. C. D. E.

9. This sheet of paper has holes punched in it. How will the paper look after it is folded on the dotted lines?
APPENDIX A - 3.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF DISCRIMINATION SKILL
In the center of this page is a sample circle. Compare the SIZE of the sample with the SIZE of each of the circles around it. Decide for each of the numbered circles if it is:

A. Smaller than the sample circle
B. Larger than the sample circle
C. The same size as the sample circle

Mark your answers below.

4. A B C
5. A B C
6. A B C
7. A B C
APPENDIX A - 4.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF CATEGORIZATION SKILL
The length of the average whale is about 65 feet. What do you think?

17. is the length of the longest whale?

A. 120 feet  
B. 190 feet  
C. 86 feet  
D. 75 feet

18. is the length of the shortest whale?

A. 6 feet  
B. 43 feet  
C. 52 feet  
D. 21 feet
APPENDIX A - 5.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF SEQUENTIAL PROCESSING SKILL
Look at the sample puzzle below. The shapes used in this sample are marked A, B, C, D, and E. Some of these shapes are not used in the other puzzles on this page. Only one shape is missing from each puzzle. Mark the letter of the missing shape on your answer sheet.

SAMPLE

4.

5.

6.
APPENDIX A - 6.

NASSP LEARNING STYLE PROFILE: SAMPLE QUESTIONS OF MEMORY SKILL
STUDY THE PICTURE BELOW CAREFULLY!
DO NOT TURN BACK TO THE PAGE BEFORE THIS ONE.

123. Is this picture:
   A. The same as the one on the page before this one?
   B. Different from the one on the page before this one?

REMEMBER THIS PICTURE!
YOU MAY NOT TURN BACK TO THIS PAGE AFTER YOU GO ON.
TURN TO THE NEXT PAGE.
124. Is this picture:

A. The same as the one on the page before this one?
B. Different from the one on the page before this one?

REMEMBER THIS PICTURE!

YOU MAY NOT TURN BACK TO THIS PAGE AFTER YOU GO ON.
TURN TO THE NEXT PAGE.
APPENDIX B.

SELF-REPORT QUESTIONNAIRE
SURVEY OF ATTITUDES TOWARD LEARNING ABOUT
AND WORKING WITH COMPUTERS

The purpose of this survey is to gather information concerning students' attitudes toward learning about and working with computers. The completion of the survey will require approximately 10 minutes. All responses will be kept confidential. Your participation is voluntary. Please return the survey to your instructor when you are finished. Thank you for participating.

1. Name: ___________________________________

2. Grade: _______

3. Sex: ___ Male    ___ Female

4. Have you ever taken a course in computer literacy and/or computer programming?
   ___ Yes    ___ No

5. Experience with learning about or working with computers:
   ___ 1 week or less
   ___ more than 1 week to 1 month
   ___ more than 1 month to 6 months.
   ___ more than 6 months to 1 year
   ___ more than 1 year

6. Check the software packages you have used:
   ___ Word Processing
   ___ Database Management
   ___ Spreadsheet
   ___ Graphing & Graphics
   ___ Programming
   ___ Desk Top Publishing
   ___ Other    Please explain: ___________________________________

7. Have you taken Upward Bound Computer Science previously?
   ___ Yes    ___ No
APPENDIX C.

COMPUTER ATTITUDE SCALE
COMPUTER ATTITUDE SCALE

Below are a series of statements. There are no correct answers for these statements. They are designed to permit you to indicate the extent to which you agree or disagree with the ideas expressed. Please circle the number that corresponds to your amount of agreement and disagreement with each statement.

1 = Strongly Disagree
2 = Slightly Disagree
3 = Slightly Agree
4 = Strongly Agree

Section 1

1. Computers do not scare me at all. 1 2 3 4
2. Working with a computer would make me very nervous. 1 2 3 4
3. I do not feel threatened when others talk about computers. 1 2 3 4
4. I feel aggressive and hostile toward computers. 1 2 3 4
5. It wouldn't bother me at all to take computer courses. 1 2 3 4
6. Computers make me feel uncomfortable. 1 2 3 4
7. I would feel at ease in a computer class. 1 2 3 4
8. I get a sinking feeling when I think of trying to use a computer. 1 2 3 4
9. I would feel comfortable working with a computer. 1 2 3 4
10. Computers make me feel uneasy and confused. 1 2 3 4

Section 2

1. I'm no good with computers. 1 2 3 4
2. Generally, I would feel OK about trying a new problem on the computer. 1 2 3 4
3. I don't think I would do advanced computer work. 1 2 3 4
4. I am sure I could do work with computers. 1 2 3 4
5. I'm not the type to do well with computers. 1 2 3 4
6. I am sure I could learn a computer language. 1 2 3 4
7. I think using a computer would be very hard for me. 1 2 3 4
8. I could get good grades in computer courses. 1 2 3 4
9. I do not think I could handle a computer course. 1 2 3 4
10. I have a lot of self-confidence when it comes to working with computers. 1 2 3 4

Section 3
1. I would like working with computers. 1 2 3 4
2. The challenge of solving problems with computers does not appeal to me. 1 2 3 4
3. I think working with computers would be enjoyable and stimulating. 1 2 3 4
4. Figuring out computer problems does not appeal to me. 1 2 3 4
5. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer. 1 2 3 4
6. I don't understand how some people can spend so much time working with computers and seem to enjoy it. 1 2 3 4
7. Once I start to work with the computer, I would find it hard to stop. 1 2 3 4
8. I will do as little work with computers as possible. 1 2 3 4
9. If a problem is left unsolved in a computer case, I would continue to think about it afterward. 1 2 3 4
10. I do not enjoy talking with others about computers. 1 2 3 4
APPENDIX D.

HUMAN SUBJECTS COMMITTEE APPROVAL
Checklist for Attachments and Time Schedule

The following are attached (please check):

12. □ Letter or written statement to subjects indicating clearly:
   a) purpose of the research
   b) the use of any identifier codes (names, #’s), how they will be used, and when they will be
      removed (see Item 17)
   c) an estimate of time needed for participation in the research and the place
   d) if applicable, location of the research activity
   e) how you will ensure confidentiality
   f) in a longitudinal study, note when and how you will contact subjects later
   g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. □ Consent form (if applicable)

14. □ Letter of approval for research from cooperating organizations or institutions (if applicable)

15. □ Data-gathering instruments

16. Anticipated dates for contact with subjects:

   First Contact                         Last Contact
   ___________ 6/14/1993  ___________ 7/12/1993
   Month / Day / Year                     Month / Day / Year

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual
    tapes will be erased:

   ___________ 12/1/1993
   Month / Day / Year

18. Signature □ Date Department or Administrative Unit

    ___________ 5-19-93
    Month / Day / Year

19. Decision of the University Human Subjects Review Committee:

    □ Project Approved □ Project Not Approved □ No Action Required

    Patricia M. Keith 5-26-93
    Name of Committee Chairperson Date Signature